

Art. 34

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CLAIMS (Art. 34 amendment (2) filed on Jan. 12, 1998)

1. A carbon material characterized in that
edge parts of a core carbon material are partially or
entirely coated with coat-forming carbon material and
that the carbon material is nearly spherical or
ellipsoidal.

2. The carbon material according to claim 1
wherein the carbon material has a specific surface area
determined by a BET method of $5\text{m}^2/\text{g}$ or less.

3. The carbon material according to claim 1 or
2 wherein the coat-forming carbon material has a lower
crystallinity than the core carbon material.

4. The carbon material according to ^{claim 1} ~~any of~~
~~claims 1-3~~ wherein the core carbon material is a carbon
material with high ^{crystallinity} ~~crystallinity~~ having a mean
interplanar spacing (d002) of (002) plane of 0.335-0.340
nm, a thickness of crystallite size in direction of (002)
plane (Lc) of at least ^{10nm} ~~10nm~~, a thickness of crystallite
size in direction of (110) plane (La) of at least 10 nm.

5. The carbon material according to ^{claim 1} ~~any of~~
~~claims 1-4~~ wherein a true specific gravity of entire
carbon material is 1.50 to $2.26\text{g}/\text{cm}^3$.

6. The carbon material according to ^{claim 1} ~~any of~~
~~claims 1-5~~ wherein a volume-based integrated value of
particles having a diameter of ^{1 μm} ~~1 μm~~ or less determined by

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11. The calcined two-layer carbon material according to ^{claim 7} ~~any of claims 7-10~~ wherein a true specific gravity of entire carbon material is 1.50 to 2.26g/cm³.

12. The calcined two-layer carbon material
according to ^{claim 1} ~~any of claims 7-11~~ wherein a volume-based
integrated value of particles having a diameter of ^{1 μ m} ~~1 μ m~~ or
less determined by particle size distribution is 10% or
less.

13. A method for producing a carbon material
having a coating layer on the surface characterized in
that the method comprises dipping a core carbon material
into a coat-forming carbon material, separating the core
carbon material from the coat-forming carbon material,
adding organic solvent or solvents to the separated core
carbon material which is subjected to washing, drying and
calcination.

14. A method for producing a carbon material
having a coating layer on the surface characterized in
that the method comprises dipping a core carbon material
into a coat-forming carbon material at 10-300°C,
separating the core carbon material from the coat-forming
carbon material, adding organic solvent or solvents to
the separated core carbon material which is subjected to
washing, drying and calcination.

15. The method for producing a coated carbon
material according to claim 13 ~~or 14~~, wherein the
separated core carbon material to which the organic
solvent or solvents are added is washed at 10-300°C.

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16. The method for producing a coated carbon material according to ^{claim 13} ~~any of claims 13-15~~, wherein the core carbon material is dipped into the coat-forming carbon material under reduced pressure.

5 17. The method for producing a coated carbon material according to ^{claim 13} ~~any of claims 13-16~~, wherein the coat-forming carbon material is coal heavy oil or petroleum heavy oil.

18. The method for producing a coated carbon material according to ^{claim 13} ~~any of claims 13-17~~, wherein the coat-forming carbon material is tar or pitch.

19. The method for producing a coated carbon material according to ^{claim 13} ~~any of claims 13-18~~, wherein the organic solvents used for washing are at least one selected from toluene, quinoline, acetone, hexane, benzene, xylene, methylnaphthalene, alcohols, oils from coal and petroleum.

20. The method for producing a coated carbon material according to ~~any of claims 13-19~~, wherein a ratio of solid matter and organic solvent or solvents during washing is 1:0.1-10 by weight.

21. The method for producing a coated carbon material according to ^{Claim 13} ~~any of claims 13-20~~, wherein a covering ratio (c) defined as weight ratio of coat-forming carbon material/(core carbon material +

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coat-forming carbon material) is $0 < c \leq 0.3$.

22. The method for producing a coated carbon material according to ^{claim 13} ~~any of claims 13-21~~, wherein the coat-forming carbon material has primary QI at least part of which is removed to reduce a primary QI content of 3% or less.

23. A method for producing a coated carbon material characterized in that the coated carbon material produced according to ^{claim 1} ~~any of claims 1-6~~ is calcined for carbonization.

24. A method for producing a coated carbon material characterized in that the coated carbon material produced according to ^{claim 1} ~~any of claims 1-6~~ is calcined for carbonization at a heating rate of up to 10°C/hr .

25. A method for producing a coated carbon material characterized in that the coated carbon material produced according to ^{claim 1} ~~any of claims 1-6~~ is calcined for carbonization in vacuo.

26. A method for producing a coated carbon material characterized in that the coated carbon material produced according to ^{claim 1} ~~any of claims 1-6~~ is calcined for graphitization.

27. A method for producing a coated carbon material according to ^{claim 23} ~~any of claims 23-26~~, wherein a surface of the coated carbon material is pretreated for

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33. A method for producing a two-layer carbon material characterized in that the coated carbon material produced according to claim 32 is calcined for

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carbonization.

34. A method for producing a two-layer carbon material characterized in that the coated carbon material produced according to claim 32 is calcined for carbonization at a heating rate of up to 10°C/hr.

35. A method for producing a two-layer carbon material characterized in that the coated carbon material produced according to claim 32 is calcined for carbonization in vacuo.

36. A method for producing a two-layer carbon material characterized in that the coated carbon material produced according to claims 32 is calcined for graphitization.

37. The method for producing a two-layer carbon material according to ^{claim 32} ~~any of claims 32-36~~, wherein a surface of the coated carbon material is pretreated for oxidation before calcination of the coated carbon material.

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Art 32

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Art 34

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CLAIMS

1. A carbon material characterized in that edge parts of a core carbon material are partially or entirely coated with a coat-forming carbon material and
5 that the carbon material is nearly spheric or ellipsoidal.

2. The carbon material according to claim 1 wherein the carbon material has a specific surface area determined by a BET method of $5\text{m}^2/\text{g}$ or less.

10 3. The carbon material according to claim 1 or 2 wherein the coat-forming carbon material has a lower crystallinity than the core carbon material.

4. The carbon material according to claims 1-3 wherein the core carbon material is a carbon material
15 with high crystallinity having a mean interplanar spacing (d_{002}) of (002) plane of 0.335-0.340 nm, a thickness of crystallite size in direction of (002) plane (L_c) of at least 10nm, a thickness of crystallite size in direction of (110) plane (L_a) of at least 10 nm.

20 5. The carbon material according to claims 1-4 wherein a true specific gravity of entire carbon material is 1.50 to $2.26\text{g}/\text{cm}^3$.

6. The carbon material according to claims 1-5 wherein a volume-based integrated value of particles
25 having a diameter of $1\mu\text{m}$ or less determined by particle

size distribution is 10% or less.

7. A method for producing a carbon material having a coating layer on the surface characterized in that the method comprises dipping a core carbon material
5 into a coat-forming carbon material, separating the core carbon material from the coat-forming carbon material, adding organic solvent or solvents to the separated core carbon material which is subjected to washing and drying.

8. The method for producing a coated carbon
10 material according to claim 7, wherein the core carbon material is dipped into the coat-forming carbon material at 10-300°C.

9. The method for producing a coated carbon material according to claim 7 or 8, wherein the separated
15 core carbon material to which organic solvent or solvents are added is washed at 10-300°C.

10. The method for producing a coated carbon material according to any of claims 7-9, wherein the core carbon material is dipped into the coat-forming carbon
20 material under reduced pressure.

11. The method for producing a coated carbon material according to any of claims 7-10, wherein the coat-forming carbon material is coal heavy oil or petroleum heavy oil.

25 12. The method for producing a coated carbon

material according to any of claims 7-11, wherein the coat-forming carbon material is tar and/or pitch.

13. The method for producing a coated carbon material according to any of claims 7-12, wherein the
5 organic solvent or solvents used for washing are at least one selected from toluene, quinoline, acetone, hexane, benzene, xylene, methylnaphthalene, alcohols, oils from coal and petroleum.

14. The method for producing a coated carbon
10 material according to any of claims 7-13, wherein a ratio of solid matter and organic solvent during washing is 1:0.1-10 by weight.

15. The method for producing a coated carbon material according to any of claims 7-14, wherein a
15 covering ratio (c) defined as weight ratio of coat-forming carbon material/(core carbon material + coat-forming carbon material) is $0 < c \leq 0.3$.

16. The method for producing a coated carbon material according to any of claims 7-15, wherein the
20 coat-forming carbon material has primary QI at least part of which is removed to reduce a primary QI content of 3% or less.

17. A method for producing a two-layer carbon material characterized in that the coated carbon material
25 produced according to any of claims 7-16 is calcined for

carbonization.

18. A method for producing a two-layer carbon material characterized in that the coated carbon material produced according to any of claims 7-16 is calcined for
5 carbonization at a heating rate of up to 10°C/hr.

19. A method for producing a two-layer carbon material characterized in that the coated carbon material produced according to any of claims 7-16 is calcined for carbonization in vacuo.

10 20. A method for producing a two-layer carbon material characterized in that the coated carbon material produced according to any of claims 7-16 is calcined for graphitization.

21. A method for producing a two-layer carbon
15 material according to any of claims 17-20, wherein a surface of the coated carbon material is pretreated for oxidation before calcination of the coated carbon material.

22. A lithium secondary battery comprising the
20 carbon material according to any of claims 1-6.

23. A lithium secondary battery comprising the carbon material according to any of claims 1-6 as material for negative electrode.

24. The lithium secondary battery according to
25 claim 22 or 23, wherein the lithium secondary battery is

a non-aqueous lithium secondary battery.

25. The lithium secondary battery according to claim 24, wherein the lithium secondary battery is a solid electrolyte lithium secondary battery.